



OPA



1659

September 8, 1994

Project No. 519063

U.S. Army Corps of Engineers
CEMRO-ED-ER (Leahy)
215 North 17th Street
Omaha, Nebraska 68102-4978

Naples Truck Stop
Vernal, Utah
Contract No. DACW45-90-D-9002
Delivery Order No. 88

Dear Mr. Hubbard:

Enclosed is the mass balance data and technical evaluation for the bioremediation system which took place on August 12, 1994. Also included is a discussion as to how the system downtime will effect the migration or the contaminant plume. Please review these documents and should you have any questions, please contact me or Dave Cochran at (412) 372-7701.

Sincerely,

IT CORPORATION

Thomas P. Mathison
Project Manager

TPM: amm
Enclosures

cc: T. Gouger, USACE
G. Wagner, USACE
H. Hays Griswold, USEPA
A. Meyers, IT

FILE PLAIN
99.15.23

Regional Office

William Penn Plaza • 2790 Mosside Boulevard • Monroeville, Pennsylvania 15146-2792 • 412-372-7701

IT Corporation is a wholly owned subsidiary of International Technology Corporation

PRPR

Bio Treatment Evaluation:

In order to assess the actual contaminant reduction attributed to the bio treatment system itself, a contaminant mass balance was conducted. This mass balance included measuring all contaminant mass flows into and out of the treatment system. The estimates of biological breakdown were from the difference between input and output.

Results of this mass balance were as follows:

INPUT TO TREATMENT SYSTEM (First bio process tank)

Total loading from water:	2.26 lb/day total BTEX
Total loading from air:	7.00 lb/day total BTEX

DISCHARGE FROM FIRST TANK

To air:	2.21 lb/day total BTEX
To water effluent:	0.034 lb/day total BTEX
Biological Breakdown:	7.11 lb/day total BTEX

INPUT TO SECOND TANK SERIES (two poly tanks)

Water input:	0.034 lb/day total BTEX
--------------	-------------------------

DISCHARGE FROM SECOND TANK SERIES (two poly tanks)

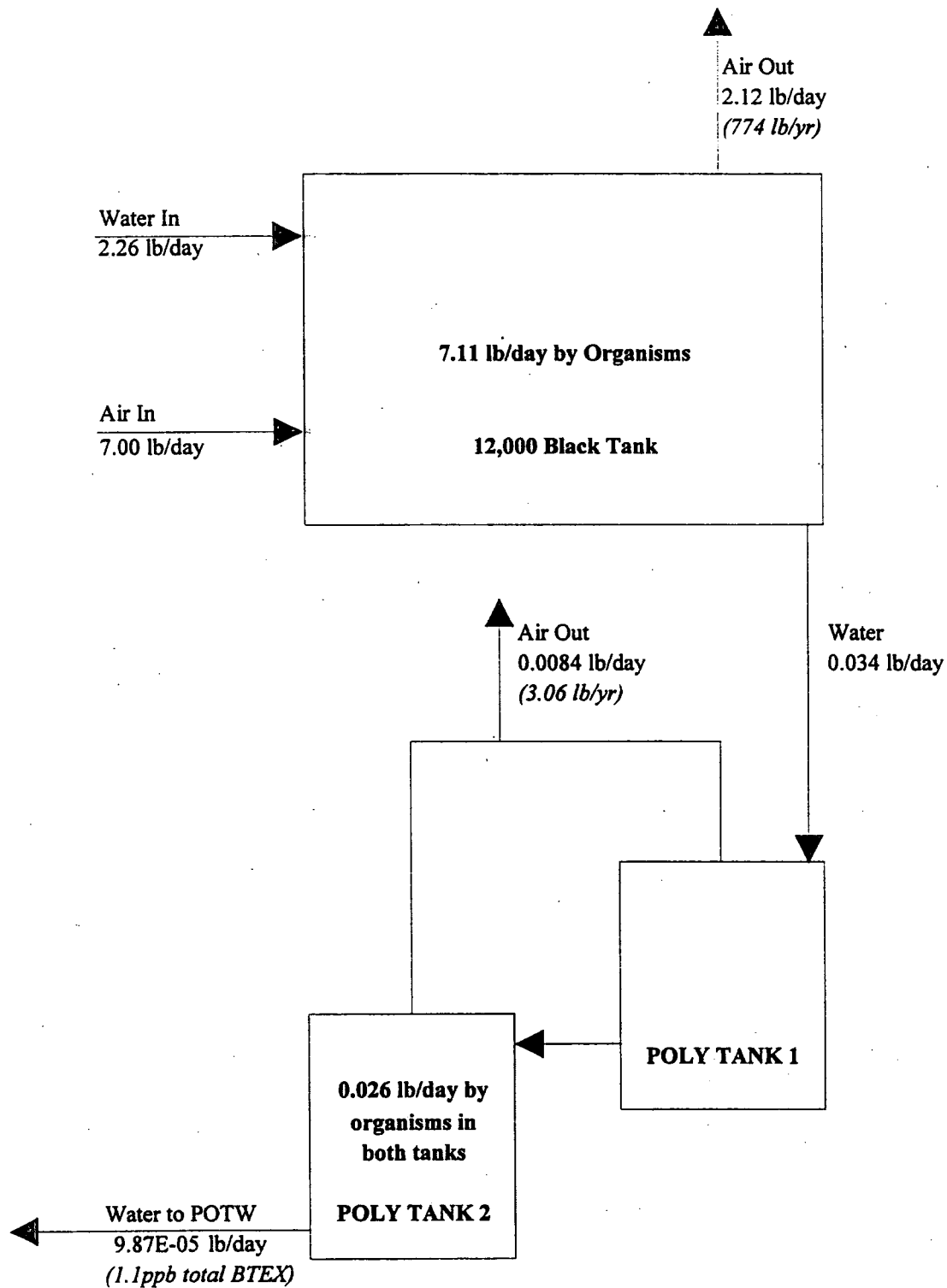
To air:	0.0084 lb/day total BTEX
To water effluent:	0.0000987 lb/day total BTEX
Biological breakdown:	0.0255 lb/day total BTEX

Overall water and air flow during the test was over 50% less than expected because of unexpected wear on the vacuum pump. This reduced the contaminant loading from water by approximately 50%. However, when the air flow was higher, the contaminant concentration in the air was about 50% less. Therefore the overall loading from air probably was not decreased because of the reduced air flow.

The biological treatment system achieved about a 77% breakdown of the total BTEX contamination in the flow stream. This level of breakdown could have been increased had the air effluent from the first bio process tank (12,000 gal. Black tank) been input to the two poly tanks.

Based on these results and the proposed design of the final bio treatment system, it should be effective enough in reducing contaminant levels for discharge to the POTW and air without the aid of any additional treatment of the water or air flow streams. This is assuming that the bio process treatment system maximizes the surface area in all treatment tanks for organism growth.

Naples Truck Stop Bio System Contaminant Mass Flow



Water Flow Into System: 7.5 gpm avg.
Air Flow Into System: 6.9 cuft/min
Total Input to System: 9.26 lb/day
Total Organism Breakdown: 7.136 lb/day
Total Atmospheric Discharge: 2.2184 lb/day
Total Discharge to POTW: 9.866E-05 lb/day

Naples Truck Stop Bio Treatment System Mass Balance

Water Contaminant Concentrations

Sample Location	System Influent		Mid Bio Flow		Bio Effluent		Trip Blank	
Sample Tag Number	SYSEFF1		BLKEFF1		POLYEFF1		Trip Blank	
Lab ID Number	B4-08-261-03		B4-08-261-01		B4-08-261-02		B4-07-370-04	
Location Description	Bio System Influent		Midpoint Bio Flow		Bio System Effluent		Trip Blank	
Sample Date	8/12/94		8/12/94		8/12/94		8/5/94	
Time	16:30		16:20		16:40		18:00	
Units	ug/L	Det.Lim.	ug/L	Det.Lim.	ug/L	Det.Lim.	ug/L	Det.Lim.
Method(s)	EPA8020		EPA8015_MOD		EPA8020		EPA8020	
Benzene	11000	100	150	2	ND	1	ND	1
Toluene	8000	100	120	2	ND	1	ND	1
Ethylbenzene	850	100	12	2	ND	1	ND	1
Xylenes, total	5400	100	95	2	1.1	1	ND	1
BTEX total	25250		377		1.1		ND	
TPH - Low Boilers (mg/L)								
Gasoline	N/A		N/A		N/A		ND	0.1

Air Contaminant Concentrations

Sample Location	System 1 Air Eff..		Blk Tank Air Eff..		Poly Tank Air Eff..		SYSTEM BLANK	
Sample Tag Number	SYSEFF1		BLKEFF1		POLYEFF1		SYSTEM BLANK	
Lab ID Number	AB7155		AB7156		AD6108		ABLKE7	
Location Description	System 1 Air Eff.		Blk Tank Air Eff..		Poly Tank Air Eff..		SYSTEM BLANK	
Sample Date							N/A	
Sample Time							N/A	
Analysis Date	8/26/94		8/29/94		8/29/94		8/26/94	
Method(s)	TO-14		TO-14		TO-14		TO-14	
dilution	1:114038		1:635.7		1:601.5		1:1	
Units	ppb (V/V)	Det. Lim.	pb (V/V)	Det. Lim.	ppb (V/V)	Det. Lim.	ppb (V/V)	Det. Lim.
CAS #	Compound							
71-43-2	Benzene	850000 23000	23000 130		250 120		ND 0.2	78
108-88-3	Toluene	740000 23000	16000 130		1400 120		ND 0.2	92
100-41-4	Ethylbenzene	86000 23000	2400 130		480 120		ND 0.2	106
IT5-30-5	m/p- Xylene	370000 23000	10000 130		2700 120		ND 0.2	106
95-47-6	o- Xylene	790000 23000	3100 130		720 120		ND 0.2	106
108-67-8	1,3,5-Trimethylbenzene	ND 23000	1100 130		380 120		ND 0.2	120
95-63-6	1,2,4-Trimethylbenzene	50000 23000	2900 130		1300 120		ND 0.2	120

Water Flow Rates

DATE	TIME	TOTALIZ (gal.)	Daily Diff. (gal.)	Avg. Flow (gpm)
8/10/94	17:25	2998827	20235	6.9
8/11/94	7:55	3007387	8560	9.8
8/12/94	7:45	3014666	7279	5.1
8/13/94	9:30	3021558	6892	4.5
8/13/94	15:00	3026329	4771	14.5
= Time interval of test		AVG. Flow=	7.5	
Source	(ug/L)	(lb/gal)	(lb/min)	(lb/day)
BTEX In	25250	2.11E-04	0.00157276	2.2648
BLK EFF	377	3.15E-06	2.3482E-05	0.03381
POLY EFF	1.1	9.18E-09	6.8516E-08	9.866E-05

Air Flow Rates

SOURCE	DIA. (in)	VEL. (ft/min)	Flow Rate (cuft/min)
Recov. Sys	6	35	6.9
Black Tank	4	1250	109.1
Poly Tanks	6	15	2.9

AIR FLOW Recov. System Effluent				AIR FLOW Black Tank Effluent			
	(lb/min)	(lb/hr)	(lb/day)		(lb/min)	(lb/hr)	(lb/day)
Benzene	0.001183	0.0710073	1.7041752	→	0.0005083	0.030498	0.731952
Toluene	0.001215	0.0729137	1.7499283	→	0.0004171	0.025024	0.600576
Ethylbenzene	0.000163	0.0097632	0.2343177	→	7.208E-05	0.0043248	0.1037952
m/p- Xylene	0.000700	0.0420046	1.0081109	→	0.0003003	0.01802	0.43248
o- Xylene	0.001495	0.0896855	2.152453	→	9.31E-05	0.0055862	0.1340688
1,3,5-Trimethylbenzene	ND	ND	ND	→	0.0000374	0.002244	0.053856
1,2,4-Trimethylbenzene	0.000107	0.006426	0.154224	→	0.0000986	0.005916	0.141984
TOTAL	0.004863	0.291800	7.003209	→	0.001527	0.091613	2.198712

AIR FLOW Poly Tank Effluent			
	(lb/min)	(lb/hr)	(lb/day)
Benzene	1.492E-07	8.951E-06	0.0002148
Toluene	9.853E-07	5.912E-05	0.0014189
Ethylbenzene	3.892E-07	2.335E-05	0.0005605
m/p- Xylene	2.189E-06	0.0001314	0.0031528
o- Xylene	5.838E-07	3.503E-05	0.0008407
1,3,5-Trimethylbenzene	3.488E-07	2.093E-05	0.0005023
1,2,4-Trimethylbenzene	1.193E-06	7.16E-05	0.0017185
TOTAL	0.000006	0.000350	0.008409

Water Concentration Conversion:

Total BTEX concentration (mg/L)*(1g/1000mg)*(1Kg/1000g)*(1lb/0.4536Kg)*3.785L/gal)=lb/gal

Air Concentration Conversion:

Air Flow Rate(cuft/min)*(MOL.WT.(lb/lb))*(1 lb-mol/385 cuft)*(Concentration(ppm))*(1E-06)=lb/min

Note: If air concentrations are in ppb, final multiplier must be 1E-09.

Naples Truck Stop System Downtime Effect

The Vacuum Enhanced Pumping System was shut down on Saturday, Aug. 13th. The effect of this on the contaminant plume will be to allow continued migration in the direction of down gradient groundwater. The continued migration will not begin immediately. There will be a lag time between the time the system was shut down and down gradient migration begins again. This time interval is dependent upon various hydrologic parameters and antecedent conditions. Due to an unusually dry winter the natural water table in the area was lower than normal. This combined with extensive pumping with the recovery system further lowered the water table in the immediate site area. These factors slow the recovery process. Depending on the conductivity of the surrounding aquifer, the recovery process could take anywhere from a day or two to more than a week.

Using a groundwater gradient calculated from field data collected on March 24th, 1994, (0.019 ft/ft) and an approximate hydraulic conductivity (calculated from the pumping test) of 40 ft/day, the groundwater velocity is 0.76 ft/day. This groundwater gradient is about 18% higher than the gradient estimated by EPA's TAT Team. The hydraulic conductivity used was the highest calculated from the pumping test data. These two factors combined yield the worst case estimate of groundwater/contaminant velocity.

During pumping, RW-01 was the only well showing free product recovery. Using RW-01 as the leading edge of the free product plume, over 260 days would pass before the free product reached RW-06. Over 450 days would be required for it to travel to RW-07. There are two sets of recovery wells (RW-05, RW-06 and RW-07, RW-08) between the estimated edge of the free product plume and the end of the dissolved phase plume. These wells will more than capture any product moving down gradient from RW-01.

The last round of groundwater sampling the end of June detected 24600 ppb total BTEX in MW-01. In 30 days this approximate concentration contour would have traveled 23 ft. The June sampling detected 17800 total BTEX in RW-08. In 30 days this concentration contour would also have traveled 23 ft.

RW-08 showed 17800 ppb total BTEX the last sampling round, however no BTEX was detected in MW-14 or MW-15. It would be advisable to collect one round of groundwater samples in all wells parallel and down gradient to the plume just prior to start up of the full recovery system.